# MODIS DATA STUDY
# TEAM PRESENTATION

**May 10, 1991**

## AGENDA

1. Action Items

2. Assumptions/Tracking List

3. MODIS Design Issues

4. MODIS Simulations

## ACTION ITEMS:

04/26/91 [Lloyd Carpenter and Team]: Review the request for MODIS product information that was received from Paul Hwang, compile required information, and draft a reply letter by May 10th. This has been completed and delivered to Al Fleig on May 9th. STATUS: Closed

04/26/91 [Team]: Contact the University of Miami to determine their data quality control requirements for Level-1A data. Miami requirements will be included with those of other team members. STATUS: Closed.

04/26/91 [Lloyd Carpenter and Team]: Determine the instrument point-of-contact for data issues relating to the MODIS-N and MODIS-T instruments and initiate discussions relating to features of the instrument/ground-processing-system interface. For MODIS-T, contacts have been identified for specifications, hardware, and data systems questions. For MODIS-N, we may need to wait until the contract is signed to get definitive answers to questions. STATUS: Open.

04/26/91 [Team]: Review the MCST distribution of MODIS Geometric Knowledge and Control Assessments, identify salient points, and recommend future related SDST activities. This item was presented at the May 3rd meeting by Phil Ardanuy. Further work is needed. STATUS: Open.

05/03/91 [Team]: Document plans for Level-1A and Level-1B processing, and indicate what information will be included in each product. Include a list of assumptions, brief rationale, scenarios, and trade-offs. Prepare an initial draft May 10th. The final draft should be ready on May 17th, and it should be ready for mailing to the team members by May 24th. STATUS: Open

05/03/91 [Team]: Prepare a bi-weekly assumptions list, to be included in the minutes once a month with the changes highlighted, and to be distributed at some interval. The list is included in the attachments. Updates will be made on a regular basis. STATUS: Closed

ASSUMPTIONS/TRACKING LIST
for
The MODIS Level-1B Processor Design
MODIS Science Data Support Team
2 May, 1991

This document contains not only the design assumptions used to derive the Level-1B design but also a list of items that need to be tracked or resolved as part of the overall MODIS Data Study Team. The assumptions lists for the other levels of the MODIS data system design should be consulted for additional assumptions and tracking items.

## Anchor Point Coordinate Systems

Earth location at the anchor points will be in the Latitude-Longitude coordinate system when appended to the Level-1B Data Product. The locations will be determined within the MODIS Level-1B program internally in a cartesian coordinate system corresponding to the EOS inertial coordinate system. The Earth will be represented by the oblate spheroid (two axis ellipsoid) Earth Model using the 1984 coefficients. Forward and reverse transforms to and from these coordinate systems will be generated and/or approved by the EOSDIS office to ensure that all instruments data in addition to MODIS data will be properly registered.

## Data Granule Sizes

The science content of the Level-1B data granule will be spatially equal to or smaller than the Level-1A data granule. This implies that only one input data set (Level-1A product) will be required to produce one or more output (Level-1B data product) data sets. The Earth ground coverage of the Level-1B data granule will be less than or equal to the Earth ground coverage of the Level-1A data granule.

## Browse Requirements

It has been assumed that there are no Browse data set generation requirements on the Level-1A program. These are expected to be performed in the Level-1B processing, although they have not been included in the design at this point.

## Land/Ocean/Other Flag

The current design for the Level-1B Data Product includes the provision for calculating the ground location of the pixels at selected points across the scan (anchor points) using a calculated Earth model without any correction for elevation. This is purely a geometric calculation and gives the Earth oblate spheroid intersection with selected instrument IFOVs in addition to azimuth and elevation (zenith) angles to the Sun and satellite from the selected ground anchor points. Any use of a terrain elevation data set for further correction of the pixel locations (ground anchor points or all scan pixels) is delayed until the Level-2 processing. This philosophy brings up many points of discussion, such as why are ground locations performed in Level-1B processing (cloud determination perhaps) instead of MODIS IFOV pointing vectors, when should an land/ocean flag be determined, and if an off-Earth or Moon looking indicator should be included? This area needs further clarification with appropriate logical decisions from the various land, ocean, and atmospheric users instead of following historical precedent.

## Science Data Quality

There appears to be some interest in performing a science data validity check based upon the science imaging data only, perhaps as a histogram of imaging data. The comparison of ICC data with telemetered data has been deleted from the level-1A processing leaving the desire for imaging verification in the level-1B processing. Many data quality checks in addition to the obvious status checks could be performed by either the MODIS or Characterization processes. These may include frequency domain transformations (i.e. Fourier), inter-band covariance, and spatial statistics.

## In-Situ Data Requirements

It is assumed that no in-situ data input is required to generate MODIS Level-1B products. This item will be determined by the calibration and characterization team. If in-situ data is required then navigation must be performed to determine the MODIS instrument radiance values corresponding to this ground based data. The possibility exists for more than one orbit (Level-1A granule) of data to be required to find the necessary in-situ located radiance values. If this is true, have these required orbits been processed before or after the current orbit? The resolution of this item has been deferred until a later date (TBD by J. Barker et al).

## Data Availability

The design currently has a provision for asking the DADS for the data set sizes and completeness rather than assuming that the SCA process will determine this information as part of the scheduling activity. This assumption requires the MODIS processor to have decision making ability to determine the desirability of continued processing if the data set is incomplete or a similar anomaly has been detected.

## Anomaly Detection

The design has provisions for generating control flow messages upon the detection of an event or problem from the telemetered data, where a problem is designated as a potentially catastrophic problem and an event is a non catastrophic event. The messages are passed internally within the MODIS-1B processor to a control section that posts the messages to the MODIS Processing Log. The messages may then be passed to external processing functions via the SCA if it would be desirable. A list of problems and anomalies to be checked will be determined at a future date when the instrument specifications are further defined. These messages do not apply to any comparison with the ICC command log.

## Data Compression

The processing design has no provision for performing any type of data compression. Any data compression is assumed to be performed in an external (to the MODIS processor) process, utilizing either a software or hardware approach.

## MODIS-T Tilt Stability

An assumption is made that an indicator in the telemetry stream will be provided from which the stability of the tilt angle can be determined. This may be a 'tilt in progress' bit or an encoder before and after science scan position or similar indicator. The best current information on the

instrument indicates that a 40 degree tilt may be performed and the tilt stabilized during the back scan portion of the 4.5 second total scan interval. This would allow the stare and stair step modes to be accommodated without effecting the anchor point ground location accuracies.

# MODIS Design Issues
## 7 May, 1991

This document lists decisions (and their consequences) that were made during the preliminary design of the MODIS data product generation program. This list of items is meant to be reviewed by MODIS Team Members or other interested parties to determine which decisions made during the course of the design effort will affect the various Team Member capabilities. This list is an on-going document to inform and resolve potential problems in the coordination between MODIS members and data system designers at the earliest possible time frame. Pro and Con discussions will be included with possible scenarios and consequences. Recommendations will be derived and included as a result of group discussions.

## Guidelines for Processing Levels

**Level-0:** Packets of raw telemetry, as generated at the S/C platform.
**Level-1A:** Raw data as generated by the instrument, not packetized.
**Level-1B:** At satellite radiances, calibrated.
**Level-2:** At ground radiances, atmospherically corrected.

## Geolocation of Pixels
## (Coordinate Systems, Parameters, and Flags)

At which level of MODIS processing is geolocation performed?
Choice of coordinate system for internal and external uses.
List of parameters to be appended to the data product to perform ground location. I.e. az-el angles, lat-long (or other), Earth radius maybe.
Flags indicating off-earth, moon, land, ocean, etc

## Appended S/C Ephemeris

All S/C auxiliary information necessary to determine the pixel ground location points is appended to the Level-1A product as a convenience to the Level-1B processor. Expected data includes but is not limited to the S/C platform position and attitude, other instrument attitudes that will affect the MODIS instrument pointing dynamically, S/C thermal data to derive platform deformations, and S/C and/or MODIS attitude deviations data base. **PRO** This keeps most of the data required for further MODIS processing together in one data set.
**CON** Much of this S/C data will be stored redundantly in more that one location.
**Consequences** Possible loss of concurrency. If the S/C ancillary data is updated for some reason after MODIS Level-1A processing, the data within the MODIS data product will be invalid without knowing this fact.

## Determination of Data Availability

The decision was made that the EOSDIS scheduler (SCA) would schedule the MODIS processors based upon the requirement to process data, not the availability of that data. This implies that the MODIS processors will interrogate the DADS to determine data set availability and size before processing data. However, no provision of the scheduler has been found that can handle the case of a PGS process self terminating without processing its assigned data set. This leaves an inconsistency in the current interface methodology between the MODIS processors and the SCA.

# Problem and Event Routing
## (MODIS Processing Log)

### Data Granule Sizes

### Metadata vs Data Product Headers

### Browse Data Generation

### Byte Alignment and Data Compression

### Off-Earth (Moon) Data